LOGISTICS AND NONLINEARITY: A PHILOSOPHICAL DILEMMA

A Monograph
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This monograph discusses the dilemma that current logistical thinking and doctrine face as they enter the 21st Century. Current logistical thinking is grounded in the structures, organizations, strategy, and equipment of the Cold War. As the Army moves into the era of information age technology this model is no longer valid. This monograph asks if the U.S Army needs to change the fundamental way it thinks about logistics in order to meet the requirements of the 21st Century.

This monograph first examines the historical basis of the U.S. Army's current logistical doctrine. It then examines the changing world situation that this doctrine faces. Next, it analyzes the adequacy of current doctrine to lead logistics into the 21st Century, with special emphasis on the theoretical foundations of logistical theory.

Finally, this monograph discusses some shortfall in current logistical theory and makes some recommendations for how this theory can be improved in order to meet the demands of information age warfare in the 21st Century. These improvements in theory will assist logisticians in meeting the demands of a changing army.

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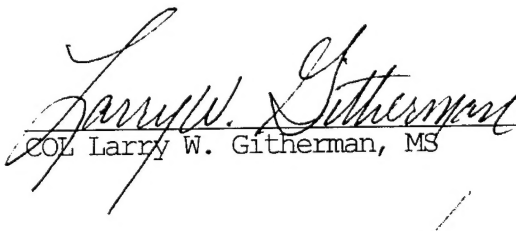

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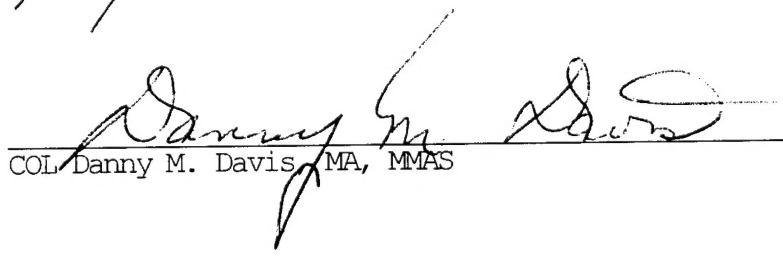

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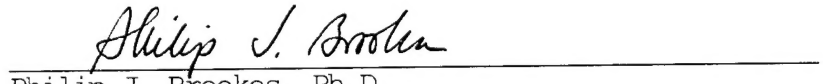

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Table of Contents

CHAPTER 1

Introduction

This study answers the following questions: How does a force projection army and a nonlinear battlefield affect current logistics thinking, and is it time for a fundamental change in doctrine? The word "fundamental" in this case describes the basic theory underlying current logistical thinking. This study will draw conclusions and make recommendations regarding the current status of logistics theory and its adequacy to support the military into the 21st Century.

This monograph answers the following three supporting questions:

1. What are the presuppositions that underlie current logistics thinking?

2. What type of logistical thinking and doctrinal orientation is needed to support a force on a nonlinear battlefield?

3. What are the other factors that will affect the logistical operations of the Army as it enters the 21st Century?

By answering the research question and the three supporting questions, this monograph will draw some basic conclusions and make some general recommendations. This study will not exhaust this subject since the topics of logistics and the nonlinear battlefield are too extensive to be dealt with in a single study.

This monograph aims to do for logisticians what Immanuel Kant said David Hume did for him. Kant remarked that he had little use for most 18th Century philosophers who had preceded him. He believed, in general, they had contributed little to the progress of understanding

thought. He had, however, a special place in his heart for Hume, since according to Kant, Hume had awakened him from his "dogmatic slumber" and forced him to look at the world in ways he had never done before. By forcing Kant to step back and examine the very fundamental nature of his most basic metaphysical beliefs, Hume had aided Kant in becoming a better thinker.

This monograph is designed to challenge logisticians to step back and examine their fundamental beliefs about the means, ways, and ends of logistics. It is not enough for logisticians to ask if they need to change the way they operate. Logisticians must ask if they need to change the way they think about the whole problem.

This topic was selected because of the current predicament logisticians face while practicing the art of logistics on a nonlinear battlefield. While the ideas of logistics and nonlinearity may not be mutually exclusive, they are close to being so. Hence, the idea of a "philosophical dilemma" was selected to illustrate the problem.

This monograph argues the practice of logistics is an art, founded on a belief in predictable, quantifiable data. Otherwise, the idea of consumption rates, stockage levels, and a fully mission capable status have no meaning. Current army doctrine emphasizes the five characteristics for combat service support (CSS): anticipation, integration, continuity, responsiveness, and improvisation.[2] These characteristics may not sound quantifiable, however, within the paragraphs explaining each term one finds such phrases as "Requirements

must be accurately projected," "Forces must be tailorable to meet force projection requirements...," and "Improvisation helps units meet CSS needs with available resources and may call for nonstandard solutions."[3]

These explanations are helpful in providing logisticians with guidance regarding how to solve problems. They do, however, imply there are predictable, quantifiable answers for all types of logistical problems. The significant problem develops when one applies the idea of logistics, i.e. "the process of planning and executing the sustainment of forces in support of military operations,"[4] against the idea of nonlinear military operations (i.e. occurring as the result of a nonadditive operation - having a numerical value different from the sum of the component parts).[5] This produces a true philosophical dilemma. Specifically, how does one plan and project quantifiable data to support a process that by definition is nonadditive in nature? This question must be answered.

War probably never has been a truly linear process.[6] However, within the U.S. Army, it is now widely believed that future wars will be less linear than previous wars.[7] Assuming this to be true, it is important that all aspects of war, to include logistics, be periodically examined to determine their roles on the future battlefield.

This monograph is written for logisticians, and those interested in the relationship between operations/tactics and logistics. It will touch on all levels of war, however, most of its discussion will center on the operational and tactical levels of warfare. It will discuss doctrine,

but will primarily be concerned with the theory and concepts that form the foundation for doctrine. Its thesis is that the key to getting doctrine correct is to get the underlying theory and concepts correct. If the foundational theory is incorrect, or at best misguided, then getting the corresponding doctrine correct would be a matter of pure chance.

Recently, much has been written about the requirement for a change in logistics doctrine.[8] Concurrently, there has not been that much written about changing logistical theory.[9] This study partially fills this gap.

This study has two major limitations. These are (1) The research is limited to published sources, and (2) The study focuses almost exclusively on army, and in some cases joint logistics, to the exclusion of any unique aspects of Air Force, Navy, and Marine Corps logistics. Neither limitation prevents the study from achieving its stated purpose.

The monograph limited its research to published sources for several reasons. The most important reason was that published accounts represent the author's most accessible and refined position. In other words, it is the position the author was willing to show to the world, and have it recorded for history. There is nothing wrong with conducting interviews, or using excerpts from speeches and briefings. In many instances these can be very informative. Still, the ideas and opinions that influence theory and doctrine are those that are written,

and most often those ideas written for professional journals. In the case of this study all the published sources used were books, professional journals, or major magazines.

This study concentrates on logistics in the U.S. Army. In some cases it discusses joint logistics, since at the strategic and operational level of war it is almost impossible to discuss army logistics without discussing joint logistics. The emphasis for this study was the theory and concepts that form the basis for army logistics doctrine. Because of this it was pertinent to concentrate on army logistics. This is not meant to imply that the unique aspects of Air Force, Navy, and Marine Corps logistics are unimportant. It is rather that they have had limited influence on army logistics doctrine.

In addition, this study does not extensively discuss two other areas: matériel acquisition and the defense industrial base. These areas are critical to any study of strategic logistics, however, their impact at the operational and tactical levels are less direct. Matériel acquisition and the defense industrial base are areas that merit study, it is just that the size and scope of this monograph do not lend itself to such a study. These topics would be better covered in studies that can devote their full attention to these important areas.

Despite the limitations of this study, the material presented is adequate to cover the topic. Anyone interested in studying how theory and concepts have affected logistics thinking will find this study an introduction to the topic. The hope is that anyone reading this will

periodically take time to stop and reflect on how the U.S. Army developed its current logistics doctrine, and ask what are the basic ideas on which this doctrine is founded.

CHAPTER 2

Discussion

This chapter is divided into three parts. Part one discusses the historical and theoretical foundations of current logistics. This will be a brief overview of the topic. It discusses two terms: paradigm and reengineering that presently dominate the U.S. Army's discussion of many, varied topics. An understanding of both is necessary in order to understand the current discussion of a changing army. Both terms appear so often in military and civilian literature, that it is impossible to discuss information age technology without some understanding of both terms.

Part two discusses the challenge of logistics in light of the revolution in military affairs, the changing world situation, and the changing American political and economic situation. It explores the challenges these changes have and will place on the Army's logistical outlook and orientation.

Part three examines current logistics thinking and doctrine. This section explores the status of logistics theory and doctrine and its likely directions in the near and medium term future. This discussion helps to set the stage for an analysis of the problem.

Paradigms and Reengineering

"Paradigm" and "Reengineering" are two terms in common use for writers in the military as well as those in the business and scientific community. These terms have varying meanings depending upon who uses

them. In this era of drawdowns and cost cutting these terms have taken on almost magical qualities, concurrently promising improved efficiency and reduced costs. This makes these ideas very attractive to anyone who is trying to change something. It is important, therefore, that one have some understanding of their meaning and usage. This monograph will therefore devote some space to discussing their meanings before moving on to describe the historical and theoretical foundations of logistics.

The terms "paradigm" and "paradigm shift" are widely used in today's Army. One of the biggest proponents for this usage was, and still is, General (Retired) Gordon R. Sullivan, former Chief of Staff. General Sullivan was highly influenced on this subject by such thinkers as Thomas S. Kuhn[9] and Alvin and Heidi Toffler.[10]

Thomas Kuhn, illustrating how complex the idea is, defined paradigm as the following:

> On the one hand, it stands for the entire constellation of beliefs, values, techniques, and so on shared by the members of a given community. On the other, it denotes one sort of element in that constellation, the concrete puzzle-solutions which, employed as models or examples, can replace explicit rules as a basis for the solution of the remaining puzzles of normal science.[11]

The Tofflers are more concise in their definition, describing paradigms as a "hidden code - a set of rules of principles that run through all its activities like a repeated design."[12] It is safe to say that most military writers use the term "paradigm" to mean a model, belief, concept, or presupposition about a given problem or situation. General Sullivan has described a "paradigm" as an underlying concept, and a "paradigm shift" as a "conceptual shift."[13]

General Sullivan's ideas about "paradigm shifts" have wide influence throughout the Army. He believes the two most significant shifts facing the U.S. Army are (1) that the strategic paradigm of the Cold War - preventing the spread of communism - does not fit the realities of today's world; to use it to solve new problems is to guarantee failure, and (2) there is a conceptual shift in the idea of when it is appropriate to employ military forces to support a wide range of activities ranging from war to peacetime relief operations.[14] General Sullivan's two paradigm shifts are broadly based on an all encompassing shift summarized by the Tofflers who write, "as we transition from brute-force to brain-force economies, we also necessarily invent what can only be called 'brain-force war'."[15] This is a conceptual description of information war.

General Sullivan basically accepts the Kuhnian idea that "paradigm shifts" are distinct occurrences, and that once they have occurred they are irreversible. The vast majority of current military writers, under the influence of General Sullivan, understand and use the term in this manner.[16]

There is not universal agreement within the scientific and philosophical communities that "paradigm shifts" in the Kuhnian sense truly occur. One objection raised is "shifts" are always occurring and that there is never a distinct shift or revolution in thought. Another belief is multiple paradigms may affect a given topic, and thus attributing a shift in thought to any particular paradigm is pointless. Still another position holds that many complex factors affect any given

body of thought and a significant change in any of these factors can affect the thought pattern even though the "paradigm" (the model or concept) remains valid.[17] The key point for this study is to understand that the military and scientific use of the term "paradigm shift" are not always identical. This is especially important when military writers borrow ideas from the scientific community. Otherwise, it is possible to borrow an idea that, while it sounds the same, has different connotations. This can lead to confusion, and possibly drawing the wrong conclusion.

Like "paradigm," "reengineering" is a term implying different meanings to different users. It is a term widely used in today's army literature. Reengineering is currently a broad term used to describe actions that under varying circumstances include downsizing, restructuring, reorganizing, realignment, etc.. Reengineering incorporates all of these ideas, but its meaning is not fully captured by any of these terms. Trying to define reengineering precisely reminds one of Mr. Justice Potter Stewart's now famous comment about obscenity that,

> Although we have assumed that obscenity does exist and that we "know it when (we) see it," we are manifestly unable to describe it in advance except by reference to concepts so elusive that they fail to distinguish clearly between protected and unprotected speech...[18]

General Sullivan has provided one definition by writing, "The most basic and common feature of a reengineered business is the adoption of the network as their organizational model instead of the assembly line attitude."[19] Others have described reengineering by saying, "don't

automate, obliterate."[20] Between these extremes lie a number of positions. Michael Hammer, one of the original prophets of reengineering, assumes a somewhat middle position and provides a good working definition by saying,

> Re-engineering is the radical redesign of a company's business processes, reinventing the way the business operates in order to meet the demands of a modern economy. It is about rethinking work, not eliminating jobs.[21]

This monograph will use some variant of Hammer's definition throughout, unless it states otherwise.[22] It is important to discuss "paradigm" and "reengineering" because these terms have assumed such a large role in any philosophical discussion of change in the U.S. Army. Without a basic understanding of these terms it is impossible to have such a discussion.

The Machine As the Model

The theoretical foundations of current logistics thinking were shaped primarily by the Second World War and the post-war period. Many of the foundations for this influence were in place prior to World War II, however, it was the experiences of WWII and the Cold War that have most influenced current thought. General Sullivan has called this Cold War paradigm "The machine as a model"[23] era with the most distinct characteristics being:

- Machine as a model
- Paced, sequential, continuous, long-run production
- Mass output[24]

James Huston in his monumental study The Sinews of War: Army Logistics 1775-1953 states the strategy of the U.S. Army from the beginning of World War II onward was based on a logistics strategy of "out-producing the enemy."[25] Houston, along with several others, believes this strategy of "out-producing the enemy" was the philosophical foundation of President Roosevelt's concept of an "arsenal of democracy."[26]

Huston points out, however, that this type of logistics strategy is not without its problems. He concludes that with the exception of acute periods of actual war, the U.S. government has been very reluctant to spend large amounts of money to "out-produce the enemy." Huston describes this as a situation of "feast or famine"[27] in which "strict limitations in peace-time, with almost never enough appropriations even to build up the most modest reserves; then huge appropriations in wartime with a mandate to spend them wisely and quickly."[28]

This type of logistics attitude at the strategic level produces many challenges, three of the more serious ones being (1) tactical and operational designs that presuppose matériel preponderance when in fact the resources needed are not currently available,[29] (2) the trauma caused to the logistics system by the reception of large quantities of supplies once combat operations have begun,[30] and (3) the extreme vertical integration of logistics functions during peacetime in order to gain maximum efficiencies.[31]

The effect of this was the U.S. Army, throughout the post World War II period, based its strategy, operations, tactics, and logistics on a

presupposition of matériel preponderance, even if it was acknowledged that short of war much of this matériel would not be available.[32] While there was discussions throughout the logistics community about the need for precise requirements,[33] the prevailing attitude was that, all things being equal, more supplies were better.[34]

There are many reasons for this type of mindset. Two of the most important ones were

- A genuine belief that a preponderance of matériel was the key to decisive victory with the fewest casualties.[35]
- A belief that initial, rapid resupply in wartime would be questionable, and the best way to preclude this was to stockpile as many supplies as possible (budget constraints permitting) in overseas and CONUS locations.[36]

This belief in the unquestionable value of matériel preponderance helps explain why efforts throughout the 1970's and 1980's to reduce excess and make better use of stockpiled supplies were largely unsuccessful. General Magruder once remarked most measures to redistribute excess and use surplus matériel are of marginal value. The key is to prevent their accumulation, and to do this you have to change the way people think.[37] The fundamental mindset is the key ingredient in way people look at logistics.

The fact the logistics mindset of the U.S. Army did not significantly change from the end of the Second World War to the end of the Cold War is not meant to imply that there were no changes. There were numerous changes. Among the more important changes were the reorganization of the Division Support Command (DISCOM) into main and forward support battalions, the formation and alignment of corps

support groups, the adoption of Air Land Battle, a more tactical focus for selected theater support units (general support maintenance, Test Measuring and Diagnostic Equipment (TMDE), etc), and consolidation and realignment of army depots. All these changes were significant and cannot be ignored. The argument is they were changes in degree not in kind. They were aimed at improving efficiency, within the existing system, not a philosophical change in the way logistics should be done.

The belief in matériel preponderance and a desire to "out-produce the enemy" are historical legacies with which the U.S. Army is still living. The next section will illustrate the challenges this type of mindset faces in a changing world.

The Challenge of the Future

It is not a simple matter to describe all the major challenges that face the U.S. Army as it moves into the 21st Century. One must first acknowledge there may be challenges ahead that have not yet been recognized. It is also possible currently perceived challenges may, in the end, not prove to be as significant as they are now thought to be. With these thoughts in mind, it appears that the major challenges for the Army fall into three broad categories. These are (1) the impact of the Revolution in Military Affairs (RMA), (2) the changing world situation, and (3) political changes within the United States. This monograph will briefly explain each of these changes.

The RMA is not easy to describe. It is complex, and has many dimensions. There is far from universal agreement on the meaning and

implications of this whole idea. A working definition of this "revolution" is provided by Oliver Morton when he writes, "The technologies of warfare are undergoing revolution. The most important weapon now is information."[38] The ideas of the RMA and its derivative "information age warfare" are that changes in technology will make information the primary weapon on future battlefields.

How this revolution will affect the battlefield in the long term is still uncertain. Some of the important impacts on the near and mid term battlefields are technological changes encompassing the digital battlefield, increased use of satellite technology, more rapid processing of information and communications, total asset visibility, precision guided munitions, etc..[39] The Army's integration of these high technology systems is producing challenges across the spectrum. The Army has been, and still is, struggling to produce an operational and logistics doctrine, along with a corresponding structure, to optimize these technological changes.

In addition, the Army also faces two other significant problems concerning technology. These are (1) No one is entirely sure where this information age technology will take the Army in the future, or what the information age battlefield will be like?, and (2) The Army still has vast amounts of "non-information age" equipment (e.g. tanks, howitzers, mortars, vehicles, etc.) that are expected to remain in the inventory for many years to come. This is even a greater problem for the reserve component, despite their increasing importance in the national military strategy. The Army must continue to employ, maintain,

and integrate this equipment while continually integrating an ever increasing amount of "information age" equipment.[40] This has proven to be challenging because the U.S. Army's logistical organizations, while moving away from their Cold War orientation, are still primarily structured to support a heavy tank/mechanized, "internal combustion engine" force. Attempts to change this logistical structure to support an army in two stages of development (transition to a force projection army and transition to an information age army) is a formidable task. In light of some other considerations this monograph will discuss, the task is even more difficult.

For the logistics community the RMA creates several challenges to include the following:

- The unknown characteristics of the future information age (brain force) battlefield.
- The type of support doctrine and structure needed to support an information age army.
- The best way to change current logistics doctrine and structure so that they can support the near term future (with its mix of Cold War and information age systems), and yet be in a position to move progressively forward into the information age.

None of the issues are easy to solve, and they become more complex as one examines some of the other factors currently affecting the military. By itself the RMA would be a significant challenge. When combined with these other factors, the problem is even more formidable.

Another significant development affecting the military is the changing world situation. This is most characterized by the fall of the Warsaw Pact and the end of the Cold War, and a break down of the Cold

War world order. The ending of the Cold War has served as a catalyst for several changes in U.S. strategy. These changes include a reduction in forward, overseas presence; a force-projection strategy; more emphasis on joint operations, and a focus on the need for the military to be able to conduct operations other than war (OOTW).[41] These changes in U.S. strategy have caused a dramatic change in the Army's orientation. In a fairly short period of time (1990-1993) the Army has officially changed from a heavily forward-based, air-land battle, east-west focused army to one whose operations are based on joint, force-projection operation, with a renewed focus on the ability to perform OOTW.

How the military can best adapt to support this change in strategy is still being debated. One logistics example is force-projection. There are ongoing discussions and opinions within the military regarding the full implications of a force-projection strategy as opposed to a forward presence strategy. Strategic mobility is of special concern.[42] Strategic mobility, while of primary concern to a force-projection force, is just one of the many operational and logistical issues raised by the change in strategy.

In addition to strategic mobility implications, emphases on force-projection and OOTW touch deeply at the heart of logistics thinking. This is partly because logistics operations are resource intensive, and usually long by nature. Logistics usually involves a lot of matériel supplies and services, and correspondingly, a lot of money. Logistical support frequently requires long lead times in order to ensure the

appropriate level of provisioned supplies and structure are in place to provide continual support. Because of the long lead times needed to secure funding and supplies, it is difficult to change logistics structures and operations in a short period of time.

Since the end of the Second World War, army logistics had primarily (Vietnam[43] and Korea[44] are exceptions) focused on supporting a war in Europe against the Warsaw Pact. Logistics for this type of war concentrated on armored/mechanized forces engaged in heavy combat. It relied initially on forward stockpiled matériel, and had extensive, established host nation support agreements. It expected to use in place infrastructure (railroads, roads, facilities, etc.), and viewed force-projection operations as strategic reinforcing operations. Logistics for this type of operation were based on detailed war plans that were regularly revised.[45]

The Cold War had influence far beyond just the wartime logistics plans and operations. It influenced the type of equipment fielded, and how that equipment was supported. Such concepts as logistics organized by echelons (e.g. wholesale and retail; direct support, general support, deport, etc.) while having their origins in World War II, adapted themselves nicely to the echelonment of the European battlefield and its supporting infrastructure. The move away from a Cold War force has caused the logistics community to question these fundamental tenants which originated in post World War II Europe.

In addition to the end of the Cold War, there are two other changes in the world situation. One of these changes is that the U.S. Government

has begun paying more attention to the threat from regional powers (e.g. Iran, China, North Korea, etc.). The other change is the proliferation of weapons of mass destruction (mostly chemical weapons), even among Third World countries. Both of these situations have wide implications for the U.S. Army, operationally and logistically. For the first time since the end of the Vietnam War, the potential truly exists for the U.S. Army to fight a major regional conflict (MRC) as a force-projection operation in an area having little or no infrastructure and no in-place host nation support agreements. This is a far different situation than supporting heavy forces, fighting from general defense positions, in Central Europe.

The last challenge is the political changes within the United States. The origin of these changes are complex and beyond the scope of this paper. It is sufficient to say that with the fall of the Soviet Union, the demise of the Warsaw Pact, and the "new world order," the American government and the populous as a whole have begun to question the size and role of the U.S. military. Some of this is facilitated by a change in perceived threats. Other concerns are about how much money the U.S. government will spend, and on what it spends that money. This change, especially the concern over spending, has had tremendous near, medium, and long term effects on the military.

In 1990, the budget of the U.S. Defense Department was 300 billion dollars.[46] In 1993, the U.S. Defense Department's budget was 297 billion dollar.[47] While more than twice the defense budget of the next highest spender,[48] it actually represented an approximate decline

of 10 percent in real terms. The projected FY 96 defense budget (which at the time of this writing has not passed) will be between 236-243 billion dollars.[49] In 1990 terms, this will represent a 31 to 33 percent drop in real spending in just seven years. The Army is expecting to receive approximately 60 billion dollars in FY 96, down from 86.5 billion dollars in FY 90.[50] This represents a decline in the army budget of 41 percent in real terms.

There are many reasons for the government's reluctance to spend more on the military. A partial, but by no means inclusive, list of reasons is

- Concern over the growing government's budget deficit and debt
- No clearly perceived threat
- Competing interests (health care, social security, etc.) for limited government revenues
- A desire to take advantage of the "peace dividend"

None of these reasons are especially new. However, when coupled with the end of the Cold War, they have taken on additional political importance in the United States. Fewer forces and no clearly perceived threat have resulted in the Defense Department in general, and the Army in particular, having far less money than they once did. This shortage of money has affected all aspects of the military to include personnel, training, operations and maintenance, procurement and modernization, the defense industrial base.[51] It appears very likely that the situation will not improve in the near future. In 1999, under the best conditions, the Defense Department's budget is expected to rise to 253

billion dollars,[52] a 9.5 percent rise over the FY 96, but still only 71 percent of the FY 90 budget in real terms. In real terms, the FY 99 budget is lower than the FY 96 budget, although in nominative terms it is higher.

Reductions in the defense budget and changes in perceived threats to national security affect logistics as much as any other area of the U.S. Army because logistics must compete with other activities for scarce resources. Even the most efficiently managed logistics operations require resources. The fact that the Army's logistics structure is still supporting a large number of systems (e.g. tanks, IFVs, howitzers, etc.) which in their present state have limited utility on a force-projection, information age battlefield, only adds to the problems of efficient allocation of resources. In an era of reduced threat, the U.S taxpayer is more reluctant to provide those resources, and subsequently, logistics activities are required to manage with less.

A question logisticians have to ask themselves is how to take current logistics doctrine and structure, based on a "brute force concept" (out-producing the enemy) in support of a Cold War army, and change this to support an information age army in an environment of uncertainty and budgetary constraints? This is the challenge for the future.

Current Doctrine and Thinking

The keystone doctrinal manual for logistics is FM 100-10, Service Support. At this time the approved version of this FM is dated 18

February 1988. A final coordinating draft of FM 100-10, dated May 1995, is yet to be approved. Since much has changed since 1988, it is not easy to define current logistics doctrine. The delay in updating FM 100-10 necessitates the use of other publications approved since the latest revision of FM 100-5, Operation, dated June 1993.

FM 100-5 states the purpose of logistics is to ensure operations succeed.[53] It divides logistics into three areas: strategic, operational, and tactical,[54] to mirror the three levels of war. This is a significant change in the organization of logistics, replacing the sustainment concepts of organization by task, the organization by echelon, the organization by area, and the concept of operational and tactical sustainment that were described in FM 100-10, Service Support (dated 18 February 1988).[55] Two other recently published FMs[56] also follow the organization of FM 100-5. FM 100-5 defines strategic logistics by saying

> Strategic logistics deals with mobilization, acquisition, projecting forces, strategic mobility, and the strategic concentration of logistics in the theater base and COMMZ. It links a nation's economic base (people, resources, and industry) to its military operations in a theater.[57]

Operational logistics is defined as the level of logistics that, "focuses on force reception, infrastructure development, distribution, and the management of matériel, movements, personnel, and health services."[58] Tactical logistics is defined by saying, "the focus at the tactical level is on manning and arming tactical units, fixing and fueling their equipment, moving soldiers, equipment and supplies, and sustaining soldiers and their systems."[59]

FM 100-5 places renewed emphasis on joint logistics, combined logistics, host nation support, and supporting OOTW.[60] It also discusses the concept of "split-based operations"[61] and puts emphasis on establishing and expanding theater log bases.[62] These concepts are far more important to a force-projection army than to a forward based army, and may account for why they received only limited treatment in the 1988 version of FM 100-10.[63]

FM 100-7, Decisive Force: The Army in Theater Operations and FM 100-16, Army Operational Support, with the coordinating draft of FM 100-10 (May 1995) reflect the general concepts outlined in FM 100-5. Reading these manuals raises the question, "What has changed?" This question is more complicated than it first sounds.

FMs (operational and logistical) published after 1990 do address the end of the Cold War and its impact on logistics. There is more emphasis on force projection, strategic mobility, operating in austere theaters, and several other related ideas. There is also considerable emphasis on the reduced funding for the military and the need to be able to support OOTW. Current logistics doctrine (as presently available) is beginning to reflect the changes brought about by the end of the Cold War, and some of the political changes within the United States. Logistics doctrine, as outlined in FMs 100-5, 100-7, and 100-16 has little to say about the RMA, particularly about information age war, because information age war has not been incorporated into U.S. Army doctrine. There are numerous articles available on information warfare, but to date there is no doctrinal publication on information warfare.[64]

Developing doctrine to support the force projection of an information age army equipped with information age equipment will be more conceptually difficult than developing the corresponding doctrine for a Cold War army. This is mainly due to the uncertainty as to how an information age army will look and function. The present difficulty is that U.S. Army is not only moving to a force-projection army, it is becoming an information age army at the same time. Furthermore, many aspects of the information age are already here, and they are actually part of functioning organizations.[65] As the analysis will show, this makes the logisticians mission doubly complicated.

This discussion of logistics doctrine and thinking, along with other changes in the U.S. military helps set the stage for the analysis. The analysis will focus on the difficulty of reconciling a logistics doctrine and thought pattern founded on the quantifiable, "more is usually better" mindset, with the impending uncertainty of the information age and the nonlinear battlefield. It will discuss how a logistics doctrine that has primarily focused on managing changes in degree is ill-suited to address the fundamental changes in kind which the information age will likely bring. It will also explore the conceptual difficulty of preparing logistics for the 21st Century, while still supporting a large number of Cold War systems that are being used in many new and innovative ways.

CHAPTER 3

Analysis

At the end of the first chapter of Book One of On War Clausewitz writes, "Although our intellect always longs for clarity and certainty, our nature often finds uncertainty fascinating."[66] He was certainly not speaking for logisticians. Logisticians prefer clarity, or at least predictable change. In a dynamic world, this clarity takes the form of calculated change. The essence of logistics is estimating requirements and finding ways to meet those requirements.

Under peacetime conditions this can involve a tremendous amount of calculation, innovation, adaptation, and just plain hard work. With the dangers and pressures of war, the task is even more difficult. Still, the belief among logisticians is that there are correct answers, that these answers can be determined, and that they will know the correct answers when they find them.

When one applies this type of thinking to an "out-produce the enemy" mindset, one has the Army's current logistical model. Based upon the particular operation, the logistician determines what is required and how to provide it. The methodology is to provide combat units what they need (plus a little extra for contingencies) so the units can generate overwhelming combat power at a given point in time in order to defeat the enemy. The logistician is prepared to out supply, out distribute, out repair, and out service the enemy in order to support the combat soldier to victory.[67]

This model is too simplistic. It ignores the fact that the U.S. government has regularly underfunded logistics requirements, and that logistics funding has tended to be one of "feast or famine."[68] Still despite the gap between theory and means, this has been the Army's basic post World War II logistic doctrine, at least until the end of the Cold War. The main concern is to discuss how the foundations and suppositions of such a model prepare it to move beyond the Cold War.

The Cold War logistics model had certain presuppositions. These were largely the product of its environment, the forces involved, the type of war expected, and the resources available. The Cold War was not truly linear. It too recognized the geometrical and paradoxical aspects of war. It did, however, have distinctly linear characteristics to its logistical problem solving approach. Some reasons for this were (1) known enemy, (2) known, defined battlefield, (3) primary weapons systems were powered by internal combustion engines and destroyed their targets with kinetic or chemical energy rounds, and (4) fairly predictable rates of consumption.

These factors helped to define what was perceived to be the Cold War battlefield. These ideas permeated most aspects of military thought. While organizations like corps, divisions, and brigades long predated the Cold War, they did lend themselves nicely to what was perceived to be a linear, echeloned battlefield. Likewise, tanks, infantry fighting vehicles, and attack helicopters are well suited for fighting other armored/mechanized forces on a Cold War battlefield like Central Europe.

The Army's logistics concepts of direct, general, and depot level support for maintenance are largely based on what was determined to be a logical way to repair internal combustion equipment on an echeloned battlefield. Over time the whole process became a "self-sustaining" one. The U.S. Army fielded equipment based on five levels of maintenance, while at the same time, establishing five levels of maintenance to support the equipment it was fielding. The Army did this for nearly 50 years. It became a tenant of faith that five levels of maintenance (periodically reduced to three or four) were needed to maintain equipment properly.[69]

One can argue the merits of this approach. This, however, is not the most important issue. The most important issue to resolve is, how well these ideas originally based on the maintaining of internal combustion equipment on an echeloned battlefield serve the U.S. Army as it moves into an era of supporting information age equipment on a nonlinear battlefield.

Information warfare and information dominance of the battlefield are nothing new. Arguably, they have always been a part of warfare. What is new is that this idea of information dominance, along with its supporting systems, is being pushed to fairly low levels (e.g., battalions and companies). The amount of information warfare tools and information now available, or soon to be available at the company and battalion level, have increased tremendously in the last ten years.[70] The issue for logisticians is not so much if the logistics system can support information age warfare systems. To a limited degree, it is

doing so right now. The challenge for logisticians is whether current logistics doctrine is conceptually prepared to support the vast influx of information age equipment that will dominate the battlefields of the future .

The situation is similar to the introduction of motor vehicles into armies in the early 1900s. By 1914 gasoline powered vehicles were nothing new. Practically all armies had at least a few of them. Still, many armies found the expanded fielding of motor vehicles during the 1920s and 1930s to be an operational and logistical challenge of a high magnitude.[71] The problem was not just one of the quantity of vehicles as opposed to a quantity of horses, it was the conceptual difference between a horse and a gasoline powered vehicle.

The skills and outlook necessary to adapt to changes in kind are not necessarily identical to those needed to adapt to changes in degree. Adapting to changes in degree is largely an additive process, with some element of anticipation involved. Because changes in degree are largely linear, it is usually possible to start from historical data, and adjust to the particulars of the current situation.

The same is not true for changes in kind. These are non-additive by nature. Changes in kind may well bear a close relationship to their predecessors, but they are not bound to them in the way changes in degree are bound to their predecessors. This is why predicting changes in kind are isdifficult. This is also the reason a logistical model built on a historical paradigm that is rapidly changing is ill-equipped for predicting and supporting future logistics requirements.

The Army's near and medium term requirements to force-project its current Cold War systems are challenging, but they are changes in degree, and within the conceptual framework of current logistics doctrine. After all, moving a tank 25 miles or 3000 miles is still moving a tank. In the near term this is complicated because the whole question of strategic mobility, the first requirement in force projection, has not been answered.[72] Likewise, heavy forces require extensive logistics support that must also be strategically moved[73], and the size of many Cold War systems (M1s, Bradleys, MLRS) make them less than ideally suited for rapid transport to all corners of the world.[74] Yet, all of these problems are additive in nature, and can be solved with the current model.

Long term force projection is different because of uncertainty. It is presently unclear exactly what types of systems will be projected. It is also uncertain what roles Cold War systems will have on the information age battlefield. There is even the issue of the relationship between physical projection, and the information age idea of virtual projection. These types of issues illustrate that planning for long term force projection is conceptually difficult than earlier force projection had been. Long term force projection planning is nonlinear. The current logistics model with it Cold War foundation is poorly postured to address such questions.

For the near term the Army is still planning to transport tanks, APCs, howitzers, and other pieces of familiar equipment. The supply system will still be providing food, shells, powder, fuzes, major

assemblies, and petroleum products. Theater support bases may be moved to prepositioned ships or to intermediate support bases (ISB), but they will still be supporting equipment very similar to what they would have supported in Central Europe. Split based matériel management centers and increased contractor support do significantly alter procedures, however, the type of support they provide are still largely traditional logistics functions.[75]

The real challenge is not how to support the current force projection army. The real test is how to position the logistics community intellectually and conceptually to support a force projection and information age army at the same time. This is not the current force, but the force that is evolving.

The information age is having the same effect on the Army that motorization once did. The Army now stockpiles supplies to prepare for contingencies and to allow for the time lapse between the identification of a requirement and the ability to fill it. If logisticians had real time situational awareness there would not be the same time lapse, and probably not the same need to stockpile. Another example concerns automation equipment. The Army's maintenance structure is still built around end item, major assemblies, and component repair being done at different levels. It is based on a number of factors to include the items to be repaired, the mean time between failure (MTBF) for the item, and the time and skill level required for a particular repair. This approach has reduced relevancy as more key systems become computers with solid state circuitry. The MTBF for predominately electrical

components or software are significantly different than those for predominately mechanical components. There is even serious talk in the business community that computers as they are known today will disappear and be replaced by small access terminals connected to centrally run, networked mainframes.[76] The factors will all potentially affect the way Army equipment is supported in the future.

One final example concerns ammunition. Already the Army uses lasers to designate targets. It will not be long before lasers become a primary means to destroy targets.[77] This will seriously alter one of the most significant logistics functions, conventional ammunition support. Logisticians must be prepared to plan for the difference between supporting a laser system and providing 350 short tons of ammunition per day.

The point of this analysis is not that the current logistics thinking is wrong. Rather, one must be very cautious in believing that it will intellectually prepare the Army for the medium and long term future. This study is entitled "Logistics and Nonlinearity, A Philosophical Dilemma." Current logistics thinking is still grounded in the doctrine, structures, organizations, and equipment of the Cold War, and is thus based on a supposition of predictable change. The dilemma is that this current doctrine is about to move into an era dominated by nonlinearity, where change is much less predictable. The challenge is how to adapt logistics thinking, and its subsequent doctrine, to meet these changes.

The discussion and analysis have shown how the current logistics thinking is still tied to the Cold War. While such a model is not without merits, its ability to support the Army as it moves into an era dominated by information warfare is questionable. The challenge in the near term is to develop a way to think about logistics which will enable logisticians to support the force projection of what is essentially still a Cold War army, and yet prepare the Army for the vast influx of information age concepts and equipment. The conclusion will list some steps that the Army should take to put current logistics thinking in the right direction in order to write the doctrine needed.

CHAPTER 4

Conclusions and Recommendations

Current logistics doctrine will have to change to support the Army as it moves into information age warfare. The first step to doing this is to understand the suppositions and concepts that support current doctrine. The next step is to identify those suppositions and concepts that should underlie the new doctrine. The third step then is to develop the new doctrine based on the new suppositions and concepts. This study is not yet prepared to do step three, however, it is prepared to make recommendations for step two. The model is based on the one outlined in TRADOC Pamphlet 525-5, especially chapters three and four.[78]

1. Do not become dedicated to a particular doctrine, organization, structure, or piece of equipment; be dedicated to the goals of the organization. The goal of Army logistics is to provide the matériel and personnel support needed to support all types of operations.[79] This principle must guide all thinking. Doctrine, organizations, structures and equipment are instruments to enable one to accomplish a goal. They are ways to an end, and not ends in themselves. None of them have to exist or be used.

The Army cannot face the future convinced that any organization (Corps, Division, etc.) must exist outside of any utility that it provides. Because something made sense on a Cold War battlefield does not necessarily imply that it will make sense on an information age battlefield.[80]

Logisticians must likewise be cautious about concepts. Five levels of maintenance and two levels of supply worked well for supporting predominately tank and automotive equipment on an echeloned battlefield. They will not necessarily do the same for automated equipment on an information age battlefield? Also, "support forward," takes on an entirely new meaning on a nonlinear battlefield. If this idea can be translated into providing support where it is needed, then it has utility. Viewed in its traditional geographical sense, it has little value.

The steps to approaching the question of future doctrine are (1) decide what needs to be done, (2) decide how it needs to be done, (3) decide how to organize to best do this, and (4) balance all of these against the resources available.[81] This is the way to approach the problem. To approach with any preconceived notions about organizations or concepts is a conceptual mistake.

2. Shape the future by dominating the present.[82] The future is likely to be very different from the way it now appears. Predicting the future is tricky and beset with danger. One of the best ways the logistics community can prepare for the future is by educating, training, and developing competent and mindful leaders and soldiers.[83] These are the seed corn for the future. This education and training must ensure a thorough grounding in the current logistics doctrine, but also place sufficient emphasis on information age technology and its likely near, medium, and long term implications. This will enable future logisticians to be participants in the developments of the

information age, and not just bystanders. General Magruder once said of planning for the future, "We are not trying to outguess the enemy or do the theater commander's thinking for him; we are trying to have available the resources the theater needs."[84] The best and most versatile resources are competent leaders and soldiers.

The Army must produce leaders and soldiers who do not have to start from scratch each time the battlefield changes. This is the true meaning of shaping the future by dominating the present. One is reminded of what the then Colonel Richard Swain wrote describing the value of studying theory and history. He wrote that its purpose was, "Not to make men clever for next time;...to make them wise forever."[85] In this era of technology and information it is well to remember that our most important capital is human capital, well educated, trained, and directed leaders and soldiers.

3. Be cautious of complete solutions and perfect knowledge. For every complex problem, someone has a simple answer, and that simple answer is almost always incomplete. Knowledge alone does not automatically translate into the ability to take positive actions. For example, total asset visibility may tell the Army where certain assets are located. If, however, these assets are on the other side of the world and there is no way to transport them to where they are needed, what immediate good does this knowledge serve? The answer is very little. The lesson is that knowledge must be matched with the ability to act on this knowledge. Otherwise the knowledge is interesting, but not useful.

This is not meant to imply that knowledge is bad. It is simply that by itself, knowledge and information are not enough. They must be matched with the means to act upon them. For the Army to make use of knowledge it must know why it needs this knowledge, what it plans to do with it, and have in place the structure and procedures for handling it.[86]

4. Beware of reengineering, paradigm shifts, and good ideas. The current military literature is full of discussions about "paradigm shifts," reengineering, and the need to learn from the business community. This type of discussion has value, but it is well to remember that concepts and ideas are tools to help the thought process. There is nothing inherently valuable about reengineering or a "paradigm shift." Instead of fancy verbiage, the Army needs serious thought. The focus of this serious thought must be what the goals of the Army are, and what the best way are to accomplish them knowing what it does about how the future will look.

This is why the suggestion that the military must adopt business practices must be studied closely. Are the goals of the business community the same as those of the military? There are many business practices that the Army would do well to study closely. These include shorter developmental times, reduced inventories, focus on core competencies, rewarding efficiency and effectiveness, and a recognition that everything has an associated cost. Yet, at the same time the Army must ask if the risks faced by the business world the same as those

faced by the military. Likewise in business, firms can ultimately pass costs on to their customers. The Army cannot do this.[87] Goals and the concept of risk provide the reality check to help determine which practices from other disciplines are applicable, and which ones are not.

5. Do not think or act in a vacuum. The information age is bringing all parts of the battlefield closer together. This is a fact of life. The U.S. Army is only one piece of the battlefield.[88] Good ideas must be horizontally as well as vertically tested for their feasibility and compatibility. A logistics concept or doctrine that is not closely integrated with operational doctrine, and also that of the sister services, is ineffective. With the emphasis now on combined operations, the Army must now even take into account the practices of other nations. Army logisticians must take their good ideas and thoughts and overlay them against the big picture before trying to use them to write meaningful doctrine.

This study has asked many questions. This is not to imply that there are no answers. It is just that questions stimulate thought, and as G. E. Moore recognized long ago,

> the difficulties and disagreements, of which its history is full, are mainly due to a very simple cause: namely to attempt to answer questions, without first discovering precisely what question it is which you desire to answer.[89]

Moore went on to add that another problem was a failure to understand the suppositions on which the questions are founded.[90]

Based on the research conducted this study is convinced that current logistics doctrine, founded on its Cold War model, is ill

prepared to support the Army as it moves into the 21st Century. The problem is not one of supporting force projection operations in the near term. This will be difficult , but more from a matériel and resource perspective than from a philosophical perspective. The philosophical dilemma will begin as the U.S. Army moves farther into the information age. That is where true nonlinearity begins. The Army's linear logistic thought process is intellectually ill-equipped to handle a change of this nature.

When this study started the preconceived belief was that the transition from a Cold War army to a force projection army would be a major intellectual challenge for today's logisticians. The research conducted indicates that this transition is not the major intellectual step. That step will come as the U.S. Army moves farther into the information age and actually begins to replace some of its Cold War equipment and organizations with information age equipment and organizations. The U.S. Army has not yet seen the great "paradigm shift." This is still the dawn of the information age. A fairly small number of information age systems superimposed on present Cold War systems and organizations does not represent a revolution. The major challenge to the logistical doctrine and concepts is yet to come. The obligation is to be prepared.

ENDNOTES

[1]Paul Edwards, ed. The Encyclopedia of Philosophy (New York: Macmillan Publishing Company and the Free Press, 1967), s.v. "Immanuel Kant," by W.H. Walsh.

[2]See FM 100-5, Operations (Headquarters, Department of the Army, 1993), 12-3 thru 12-5. Also see FM 100-7, Decisive Force: The Army in Theater Operations (Headquarter, Department of the Army, 1995), 5-21.

[3]FM 100-7, 5-21.

[4]FM 100-5, 12-1.

[5]The American Heritage Dictionary, 2nd ed. (1985), s.v. "nonlinear."

[6]For the classical explanation of this matter see Carl von Clausewitz, On War, ed. and trans. by Michael Howard and Peter Paret (Princeton: Princeton University Press, 1976), especially pages 86, 89, 101-102, 104, 119-121, and 193.

[7]See William W. Hartzog, "Crossing the Threshold into a New Age," Army vol.45, no.5 (May 1995): 21-24, David Jablonsky, "US Military Doctrine and the Revolution in Military Affairs," Parameters vol. XXIV, no. 3 (Autumn 1994): 18-36, and Gordon R. Sullivan, "Moving into the 21st Century: America's Army and Modernization," Military Review (July 1993): 2-11.

[8]See Nathan J. Power, "Force Projection Logistics," Military Review (July 1993): 45-49, John G. Roos, "Power-Projection Logistics," Armed Forces Journal (August 1995): 28-30, Jerry R. Rutherford and Daniel V. Sulka, "Making FM 100-5 Logistics a Reality," Military Review (February 1994): 11-15, and Leon E. Salomon, "Transforming Logistics for the 21st Century," Army Logistician (July-August 1995): 19-21.

[9]One current article on this subject is Christopher Papararone, "Equivalent Theory of Logistics," Army Logistician (January-February 1995): 12-17.

[9]Kuhn is credited with introducing the concept of paradigms to the non-scientific community. See Thomas S. Kuhn, The Structure of Scientific Revolution (Chicago: University of Chicago Press, 1962), 25-34.

[10]The Tofflers have written widely on the idea of "paradigm shifts," and how they affect all aspects of life. See Alvin and Heidi Toffler, The Third Wave (New York: William Morrow, 1980), 46-49, and War and Anti-War: Survival at the Dawn of the 21st Century (Boston: Little, Brown, and Company), 10-11.

[11]Kuhn, 175.

[12]Toffler, The Third Wave, 46.

[13]Gordon R. Sullivan and James M. Dubik, "Land Warfare in the 21st Century," chap in Envisioning Future Warfare (Fort Leavenworth, Kansas: United States Army Command and General Staff College Press, 1995), 7.

[14]Ibid., 7-8.

[15]Toffler, War and Anti-War, 10-11.

[16]In addition to the previously cited works by Hartzog, Jablonsky, Salomon, and Sullivan, see "Defense Technology," The Economist, 10 June 1995, Special Feature, and Johnnie E. Wilson and Roberto Capote, "Leveraging Logistics Technology Toward Force XXI," Army Logistician (July-August 1995): 14-18.

[17]For a fuller view of how the scientific and philosophical communities have reacted to Kuhn's ideas see Ludwig von Bertalanffy, General System Theory (New York: George Braziller, 1968), 18-24; Paul Edward, ed. The Encyclopedia of Philosophy (New York: Macmillan Publishing Company and the Free Press, 1967), s.v. "Paradigm-Case Argument," by Keith S. Donnellan; James Gleick, Chaos: Making a New Science (New York: Penguin Books, 1987), 35-39; Douglas R. Hofstadter, Godel, Escher, Bach: An Eternal Golden Braid (London: Harvester Press Ltd, 1979), 659-661.

[18]This quote was initially stated in Jacobellis v. Ohio (1964) (dissenting opinion) and repeated in Paris Adult Theater I v. Slaton (1973) (dissenting opinion), see Robert F. Cushman, Cases In Civil Liberties (Englewood Cliffs, NJ: Prentice-Hall, Inc., 1985), 195.

[19]Gordon R. Sullivan and James M. Dubik, "War in Information Age," chap in Envisioning Future Warfare (Fort Leavenworth, Kansas: United States Army Command and General Staff College Press, 1995), 49.

[20]"Re-engineering with Love," The Economist, 9 September 1995, 69.

[21]Michael Hammer, "Hammer Defends Re-engineering," The Economist, 5 November 1994, 70.

[22]For some additional discussions of reengineering see "The Trouble With Teams," The Economist, 14 January 1995, 61; "Fewer Bangs, More Bucks," The Economist, 15 July 1995, 60; and "Unthinking Shrinking," The Economist, 9 September 1995, 70.

[23]Sullivan, "War in the Information Age," 46.

[24]Ibid.

[25]James A. Huston, The Sinews of War: Army Logistics 1775-1953 (Washington D.C.: Center of Military History, 1966), 425.

[26]Ibid.

[27]Huston, 658.

[28]Ibid.

[29]An interesting discussion of this problem is found in Russell F. Weigley, Eisenhower's Lieutenants: The Campaign For France and Germany, 1944-45 (Bloomington, IN: Indiana University Press, 1981), 2-7 and 727-730.

[30]See Joseph M. Heiser, Jr, A Soldier Supporting Soldiers (Washington D.C.: Center of Military History, 1991), 33-38 and 61-67.

[31]For a recent discussion of this problem see Michael S. Williams and Herman T. Palmer, "Force-Projection Logistics," Military Review (June 1994): 29-39.

[32]For some interesting discussions of this problem see Huston, Sinews of War, 590 and 623, and also his later work Outpost and Allies: U.S. Army Logistics in the Cold War, 1945-1953 (Selinsgrove: Sesquehanna University Presses, 1988).

[33]For a discussion of the need for precise requirements see Heiser, A Soldier Supporting Soldiers, 171-179, and his Vietnam Studies: Logistic Support (Washington D.C.: Department of the Army, 1974), 58-72. Also see Carter B. Magruder, Recurring Logistic Problems As I Have Observed Them (Washington, D.C.: Center of Military History, 1991), 46-47.

[34]Wilson R. Rutherford, III and William L. Brame, "Brute Force Logistics," Military Review (March 1993): 61-69.

[35]I borrowed this wording from A.J. Bacevich, The Pentomic Era: The U.S. Army Between Korea and Vietnam (Washington, D.C.: National Defense University Press, 1986), 55.

[36]Heiser, A Soldier Supporting Soldiers, 177.

[37]Magruder, 125.

[38]Oliver Morton, "Defense Technology," The Economist, 10-16, June 1995. For other views of the RMA see Jablonsky; Sullivan, War in the Information Age, and TRADOC Pamphlet 525-5, Force XXI Operations: A Concept for the Evolution of Full-Dimensional Operations for the Strategic Army of the Early Twenty-First Century (Headquarter, Department of the Army, 1 August 1994).

[39]For an up-to-date listing of most ongoing army projects see "Army Weaponry and Equipment," Army: 1995-1996 Green Book, October 1995, 248-285.

[40]Ibid.

[41]See FM 100-5, Operations, V-VI.

[42]See William G. Pagonis and Jeffrey L. Cruikshank, Moving Mountains: Lessons in Leadership and Logistics from the Gulf War (Boston: Harvard Business School Press, 1992), 203-204. For more detailed studies of the strategic mobility implications of a force-projection strategy see Scott W. Conrad, Moving the Force: Desert Storm and Beyond (Washington, D.C.: National Defense University Press, 1994), David Kassing, Getting U.S. Military Power to the Desert: An Annotated Briefing (Santa Monica: RAND, 1992), Douglas Menarchik, Powerift- Getting to Desert Storm: Strategic Transportation and Strategy in the New World Order (Westport, CT: Praeger, 1993), and Paul Tiberi and James C. Wendt, Gathering the Storm: Contingency Planning and Force Projection (Arlington: Association of the United States Army, 1991).

[43]In addition to Heiser's Logistic Support, see Joel D. Meyerson, "War Plans and Politics: Origins of the American Base of Supply in Vietnam," in Feeding Mars: Logistics in Western Warfare from the Middle Ages to the Present, ed. John A. Lynne (Boulder CO: Westview Press, 1993), 271-287.

[44]See James A. Huston, Guns and Butter, Powder and Rice; U.S. Army Logistics in the Korean War (Selinsgrove: Sesquehanna University Presses, 1988.

[45]For some insightful criticism of this type of planning see Julian Thompson, The Lifeblood of War: Logistics in Armed Conflict (London: Brassey's, 1991), 289-312. Thompson has entitled this chapter "Supplying the War That Never Was - Yet." For a more positive view of American and NATO logistics planning during the Cold War and post Cold War periods see P.D. Foxton, Powering War: Modern Land Force Logistics (London: Brassey's, 1994), especially chapters 14 and 15.

[46]Morton, "Defense Technology."

[47]Ibid.

[48]Ibid.

[49]AUSA News (Arlington), November 1995.

[50]Richard L. West, "Short Rations for the Army," Army vol. 44, no. 4 (April 1994), 22.

[51]For the impact of the budget reduction on procurement and the defense industrial base see Mike Austin, "Managing the US Defense Industrial Base: A Strategic Imperative," Parameters vol. XXIV, no. 2 (Summer 1994): 27-37, John R. Brinkerhoff, "The Strategic Implications of Industrial Preparedness," Parameters vol. XXIV, No. 2 (Summer 1994): 38-47, Ivars Gutmanis, "The Future of the Defense - Related Industrial Base in the United States," Parameters vol. XXIV, no. 2 (Summer 1994): 61-76, and James S. Thomason, "Assessing Resource Options for National Security Preparedness," Parameters vol. XXIV, no. 2 (Summer 1994): 48-60.

[52]West, 21.

[53]FM 100-5, 12-2.

[54]Ibid., 12-2 thru 12-3.

[55]FM 100-10, Service Support, 18 February 1988, 1-12 thru 1-14.

[56]See FM 100-7, Decisive Force: The Army in Theater Operations, May 1995, 5-19 thru 5-22, and FM 100-16, Army Operational Support, May 1995, 3-5 thru 3-13. The coordinating draft of FM 100-10, Logistics, May 1995 also organizes the logistics battlefield in this manner.

[57]FM 100-5, 12-2.

[58]Ibid.

[59]Ibid., 12-3.

[60]Ibid., 12-6 thru 12-7.

[61]Ibid., 12-8.

[62]Ibid., 12-9 thru 12-10.

[63]FM 100-10 (1988), 1-15 thru 1-23 and 2-2 thru 2-21.

[64]Publications currently available include TRADOC PAM 525-69, Concepts for Information Operations, 1 August 1995, TRADOC PAM 525-XX, Battlefield Visualization Concept, 15 May 1995, and FM 100-6, Information Operations (DRAG DRAFT), 2 October 1995. The Joint Staff is also in the process of publishing Joint Pub 3-13, Joint Command and Control Warfare (C2W) Operations (Preliminary Coordination Draft), May 1995.

[65]See Daniel C. Parker and Jim Caldwell, "Battlefield Distribution for Force XXI," Army Logistician (July-August 1995): 36-38, and Michael P. Kelley, "CSSCS Proven in Support Operations," Army Logistician (July-August 1995): 32-33.

[66]Clausewitz, 86.

[67]See Weigley, 727-730 and Huston, Sinews of War, 425.

[68]Ibid. Also see Thompson, 289-312 and Stephen P. Ferris, "A Shortage of Seed Corn," Military Review (June 1994): 40-53.

[69]Heiser, A Soldier Supporting Soldiers, 248-249.

[70]See TRADOC Pamphlet 525-3, 3-3 thru 3-11.

[71]For some examples see Harold R. Winton, To Change an Army: General Sir John Burnett-Stuart and British Armored Doctrine, 1927-1938 (Lawrence, KS: University Press of Kansas, 1988), and Van Creveld, Supplying War, 142-148.

[72]For the current status of the strategic mobility issue see the previously cited works by Conrad, Kassing, Menarchik, Tiberi and Wendt, and Pagonis.

[73]For some idea of the quantity of supplies used by a heavy brigade or division see Battalion, Brigade, Division Logistics Pocket Battle Book (Manhattan, KS: Pocket Battle Book, 1995), 2-1 thru 2-19.

[74]See Louis C. Finch, "Keeping Forces Ready to Fight," Defense 95 (Issue 4): 2-13 and the article by West.

[75]see FM 100-5,12-1.

[76]"Will Your Next Computer Be a Tin Can and a Wire," The Economist 14 October 1995, 75-76.

[77]See Army: 1995-1996 Green Book, 285 and 296.

[78]See TRADOC Pamphlet 525-5, 1-3, 3-1,3-13 thru 3-17, and 4-1 thru 4-11.

[79]Ibid, 3-14.

[80]Ibid, 3-17.

[81]Ibid, 4-1.

[82]I borrowed this expression from LTC Charles Franklin, Seminar 3 Staff Leader, School of Advanced Military Studies, Fort Leavenworth, KS

[83]TRADOC Pamphlet 525-5, 4-4.

[84]Magruder, 44.

[85]Richard M. Swain, "'The Hedgehog and the Fox': Jomini, Clausewitz, and History," Naval War College Review (Autumn 1990), 106.

[86]TRADOC Pamphlet 525-5, 4-11.

[87]See Michael L. McGee, "Just-in-Time, or Just Too Late," Army Logistician (March-April 1995): 15-17.

[88]TRADOC Pamphlet, 525-5, 3-2.

[89]G. E. Moore, Principia Ethica (Cambridge: Cambridge University Press, 1903), vii.

[90]Ibid.

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